

Charles Ellet
Carnegie Library of Pittsburgh



Chapter 7

THE WATERWAYS AND WAR

As the ram fleet rounded the riverbend, Colonel Charles Ellet saw the Union gunboats lined across the Mississippi moving downstream toward the Confederate fleet protecting Memphis. Ellet ordered his engineer to put on all steam: eighty, ninety, one hundred pounds pressure; the *Queen of the West* and the rams that followed spurted ahead, passing through the line of slowly moving Union ironclads and aiming for cannon flashing from Confederate boats visible through the wall of smoke hanging over the river. The *Queen of the West* plunged into the smoke, lost from sight. Captain Alfred Ellet aboard the ram *Monarch* peered anxiously into the haze and finally saw the *Queen* and his brother Charles standing tall on its deck, waving his hat to direct the *Monarch* to the attack. "Follow me," Colonel Ellet shouted, "Now is our chance!" The *Queen* and the *Monarch* sliced swiftly down the Mississippi, and Confederate rams moved to meet them head on, prow to prow. A thousand feet, five hundred feet, four hundred feet. Collision would send both Union and Confederate rams to the bottom with all hands.

After the Confederate ram *Merrimac* devastated the Union fleet at Hampton Roads on March 8, 1862, near panic had prevailed in Washington. John Ericsson's *Monitor* was available to meet the *Merrimac*, but Confederates had powerful steam rams under construction at Memphis that could wipe out the Union river squadron. Secretary of War Edwin Stanton called Congressman James "Old Slackwater" Moorhead and engineer Charles Ellet to his office to discuss the emergency.

Use of powerful steamboats as rams to crush the hulls of enemy vessels was not a new idea. Ramming had been a common naval tactic since ancient times, and in 1829, after watching his *Heliopolis* smash snags from the rivers, Captain Henry Shreve had told President Andrew Jackson that the Navy should build snagboats for use as rams in combat. Colonel Charles Ellet in 1854 told the Czar that the

Russians might break the British siege of Sevastopol with a fleet of steam rams; and in 1855 he recommended the American Navy build rams. Neither the Czar, nor the Navy had acted on the plan, but in 1862 Stanton remembered and sent Ellet and Moorhead to Pittsburgh with *carte blanche*.

Ellet and Moorhead purchased the powerful coal towboats *Mingo*, *Lioness*, and *Samson* and the smaller *Dick Fulton* and *T. D. Horner* at Pittsburgh, installed timber bulkheads anchored with iron rods from stem to stern in the hull of each, and acquired the sidewheelers *Monarch*, *Queen of the West*, *Switzerland*, and *Lancaster* for conversion at Cincinnati and New Albany. Ellet completed the job in six weeks, recruited crews for what amounted to a suicide mission, and set out down the Ohio. The ram fleet was unarmed, but Ellet picked up his brother Alfred Ellet, captain of the 59th Illinois, and his regiment at Cairo to serve as marines.

Colonel Ellet took his ram fleet to Memphis on June 6 and met the Confederate river flotilla. In his afteraction report, Ellet told Stanton:

I directed my attack upon two rebel rams which were about the middle of the river, very close together, and supported by a third, a little in their rear and a little nearer to the Memphis shore. These two rams held their way so steadily, pointing their stems directly upon the stem of the Queen, that it was impossible for me to direct the pilots, between whom I had taken my stand, upon which to direct our shock; but as the distance between us and the enemy, short at first, became dangerously small, the two rebel boats, apparently quailing before the approaching collision,



Charles Rivers Ellet
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began first to back water and then to turn, thus presenting their broadsides to my attack. It was impossible to choose between these boats which to attack, for there was still a third ram within supporting distance to which I would be exposed if I struck the second, while the second would be sure to reach me if I selected the first. My speed was high, time was short, and the forward vessel presented rather the fairer mark. I selected her. The pilots.....brought the prepared bow of the Queen of the West against the broadside of the rebel ram just forward of the wheelhouse. The crash was terrific; everything loose about the Queen, some tables, pantryware, and a half-eaten breakfast, were overthrown and broken by the shock. The hull of the rebel steamer was crushed in, her chimneys surged over as if they were going to fall over on the bow of the Queen. Many of her crew, I have been told, leaped overboard, yet the rebel wreck, in consequence of the continued motion of the Queen, still clung to her bow.

A Confederate ram hit the *Queen* thirty seconds later. Ellet ran from the pilothouse to the deck at the impact to assess damages. He was felled by a Confederate sharpshooter. Alfred Ellet drove the ram *Monarch* hard into the ram that hit the *Queen* and sank the Confederate. Union rams and gunboats following the Ellets into action sank more Confederate boats and pursued the residue toward Vicksburg, and Colonel Ellet sent his son, Cadet Charles Rivers Ellet, into Memphis to raise the flag over the city.

Ellet and the Reservoir Scheme Ellet and Stanton had been adversaries in the years before the

war. Stanton once deliberately rammed a steamboat into the Wheeling Bridge, first bridge over the Ohio, completed by Ellet in 1849.

Lieutenant John Sanders began planning for the Wheeling bridge in 1838 when the river was frozen over and he could cross and recross on the ice. Construction of the National Road was then the responsibility of the Army Engineers, and Congress had requested study of a bridge at Wheeling to carry the road over the river. Sanders reported the bottom of the bridge roadway should be very high and there should be no piers in the channel to obstruct river commerce. Sanders had studied European bridges and the first suspension bridge in the United States, built by James Findlay across Jacob's Creek in 1796 on the National Road near Uniontown. He recommended the bridge over the Ohio at Wheeling be a suspension bridge supported by wire cables to obtain essential clearances for navigation.

The Wheeling & Belmont Bridge Company hired Charles Ellet, noted canal, railroad, and bridge engineer, to supervise design and construction, and by 1849 Ellet had completed the stone bridge towers and suspended a record 1,010-foot roadspan between them. But Pittsburgh rivermen employed Edwin Stanton of Steubenville as attorney to seek injunction against the Wheeling Bridge as an obstruction to navigation. Stanton dramatized the case by chartering the steamer *Hibernia*, running it full speed under the bridge, and watching with glee as the bridge span ripped away the smokestacks. Stanton took the case to the Supreme Court in 1851 and won an order for removal of the bridge, but Congress saved the bridge by declaring it part of a federal mail route.

The bridge was long a source of acrimony. Pittsburgh boats were pelted with rocks at Wheeling wharf. In line with the custom of naming boat cabins after states--staterooms--Pittsburghers labeled the toilets on their boats the Wheeling. In fact, rivermen still refer to those facilities as Wheelings. When the suspension bridge span fell in a windstorm in 1854, Pittsburgh river captains

lowered steamboat smokestacks in derision at the site and sought injunction against its reconstruction, but they failed and Ellet rebuilt it.

While at work on the bridge in 1847-49, Ellet studied historic flood and flow records, established a discharge measurement section, recorded surface velocities with loaded floats, and developed a stage-discharge curve for the Ohio, contributing a great deal to the development of the science of hydrology. He had engineered canals and reservoirs as canal feeders, and that experience plus data on the flow of the Ohio clicked in his mind. He concluded a five-foot depth for navigation could be maintained on the Ohio through regulated releases from reservoirs built on tributaries, and in 1849 he published a paper advocating such a project.

He proposed construction of high multipurpose masonry dams on headwater tributaries of the Ohio, a 58-foot high dam on the Allegheny above Franklin among them, to retain flood water for release during droughts, thereby reducing flood crest heights and flood damages and maintaining navigable depths on the lower Allegheny and Monongahela and on the Ohio.

Reservoir releases, he also claimed, could power water mills and abate stream pollution. "These things will be effected, not by main force, but by skill," he declared. "The rain gauge will indicate the approaching danger from the summits of the distant mountains; the telegraph will announce the fact at the flood-gates, and the whole may thus be controlled by the provisions of science. In fact, the desired effect can be produced by a few dams in the mountain gorges, and the constant attention of some twenty men."

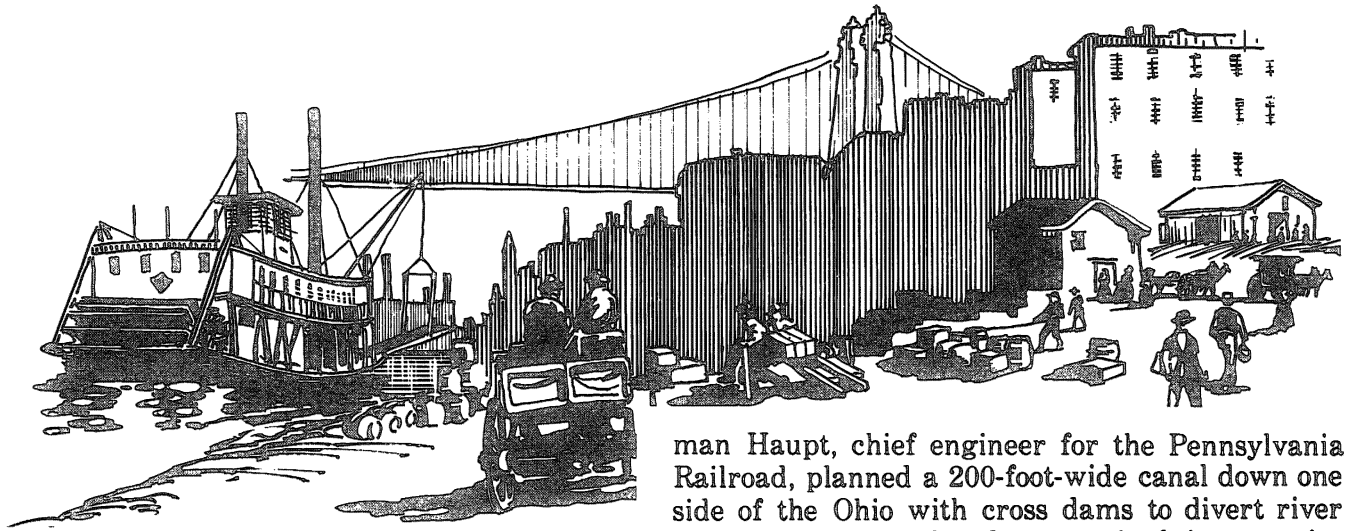
The multipurpose reservoir concept became his obsession; he even named his son Charles *Rivers* Ellet. He took the idea to Congress in 1850 and found support from Senator Henry Clay. "The conviction is strong upon me that this project will ultimately prevail," Clay said. "I think we adopt what nature

points out to us by constructing reservoirs to supply a deficiency of water in the channel at certain seasons of the year."

Congress asked appointment of a board of engineers in 1850 to study flood problems on the lower Mississippi, and Colonel Ellet, Colonel Stephen H. Long, and Captain Andrew A. Humphreys were appointed. Humphreys and Long wished detailed information about river regimen before making recommendations, and they continued their surveys and studies until 1861, when their classic *Physics and Hydraulics of the Mississippi River*, known also as the Humphreys-Abbot report, was published. Ellet, however, published his independent report, *The Mississippi and Ohio Rivers*, in 1852. In it, he recommended improvement of the Mississippi River levee system and construction of reservoirs for flood control and multiple purposes on all tributaries and subtributaries from the Appalachians to the Rockies.

Congress was at the verge in 1857 of approving surveys of reservoir sites in the Allegheny and Monongahela basins when William Milnor Roberts, the Monongahela slackwater engineer, published a devastating critique of Ellet's reservoir scheme. Roberts contended engineering and construction of a reservoir system would be more complex than Ellet imagined, that coordination of operations would present problems, and that Ellet had not fully considered the costs of relocating towns, railroads, and other property from reservoir sites.

In 1828, Pennsylvania engineer Edward F. Gay had planned a slackwater project for the Ohio from its head to the mouth of Beaver River, with four dams and locks. Roberts asked why reservoirs, an expensive experiment, were even considered for bettering Ohio River navigation when the Monongahela slackwater project had operated with success for years, as had similar projects on other tributary streams. Before Congress invested in reservoir studies, Roberts suggested it fund full investigation of all feasible engineering methods.



Wharf scene - Wheeling

"Experience, everywhere," he said, "teaches the danger of merely legislative decisions of such questions."

A third plan for the Ohio developed in 1855, largely as the result of a campaign by Pittsburgh and Kittinging newspaperman Josiah Copley. Copley informed his readers:

The year 1854 was one of unexampled drought. Never before was the necessity of the contemplated improvement more keenly or painfully felt. Your warehouses groaned under the weight of accumulated stocks, while the industry of the city languished for want of its indispensable stimulus, money. Men of enterprise found it extremely difficult to bear up under the constantly increasing weight of their responsibilities, while the poor were reduced to utter poverty....The hearts of all sickened with hope deferred, while looking and longing day after day, and week after week, for water. These calamities . . . inspired an earnest and widespread desire for an improvement of this great river, upon which we find we are so dependent, so as to render it a permanent and reliable avenue of commerce.

Copley declared government public works were not only unprofitable but also "demoralizing and dangerous." He suggested formation of a corporation similar to the Monongahela and Youghiogheny navigation companies to undertake work on the Ohio.

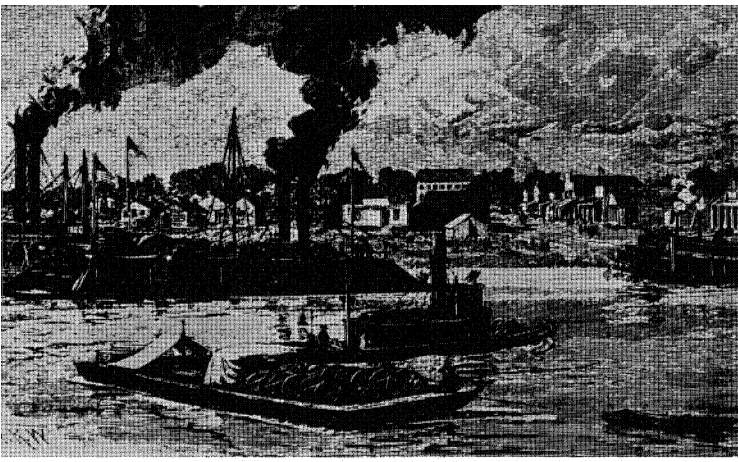
William Wilkins of Homewood, Edwin Stanton, James "Old Slackwater" Moorhead, William Larimer, and John Edgar Thompson and Herman Haupt, the latter two engineers of the Pennsylvania Railroad, formed the Ohio River Improvement Company in 1855 under Pennsylvania charter. Her-

man Haupt, chief engineer for the Pennsylvania Railroad, planned a 200-foot-wide canal down one side of the Ohio with cross dams to divert river water into the canal and automatic sluice gates instead of navigation locks to overcome stream gradient. The company took Haupt's plans to Congress in 1856 and sought a grant of public lands, similar to grants made to railroads then building, to fund construction of Haupt's Ohio River canal. Congress refused to act until the company acquired approval of all states bordering the river. "The Ohio is a national highway," a House committee declared, "and no single State can claim jurisdiction over it, or pretend to the right to disturb the flow of its waters, to regulate the transportation or tax the commerce that floats on its surface."

The ruckus among engineers over what method would best improve the Ohio temporarily died at the approach of Civil War. William Milnor Roberts went to Brazil to direct a massive railroad project; Herman Haupt became a Union Army General and director of military railways; and Charles Ellet took his ram fleet to Memphis.

The pistol wound Ellet received at the Battle of Memphis festered and he died aboard ship a few days after the battle. His body was returned to Philadelphia to lie in state under the Liberty Bell in Independence Hall and was buried with honors due a national hero. His wife died of exhaustion and grief two weeks later. His son, Charles Rivers Ellet, became commander of the ram fleet and died in the service in 1863 at age twenty.

Charles Ellet was perhaps the most original engineer of his era. His mercurial personality, however, frequently resulted in hasty and inadequate planning; his bridge at Wheeling, for instance, fell into the river and had to be rebuilt. But his multipurpose reservoir scheme, the crowning achievement of his career on which he thought his future fame would rest, eventually became what he had hoped. Every multipurpose reservoir in the nation today bears mute testimony to the innovative thinking of Charles Ellet.



New Madrid, 1862

Battles and Leaders of the Civil War

Divisive War at the Headwaters At the time Ellet was building his ram fleet at Pittsburgh, James M. Morgan, a midshipman aboard a Confederate gunboat on the Mississippi River, received orders from Commodore George Hollins to burn a deserted riverbank town that had been evacuated at the advance of a Union army. Midshipman Morgan went to the Commodore to protest the order. "If New Madrid must be destroyed, don't send me to do it," he said. "My grandfather, Colonel George Morgan, founded the town." Commodore Hollins considered the midshipman's protest a few moments, then responded that it seemed appropriate for a descendant of the town's founder to destroy it. Morgan did his duty with regret. "I had undone the work of my ancestor," he said, "and I was not particularly proud of the job."

James Morgan's parents had moved from Chartiers Creek to New Orleans, and Morgan had resigned from Annapolis in 1861 to join the Confederate navy. George Washington Morgan, another grandson of Colonel George Morgan, had moved from Chartiers Creek to Ohio. He became a Union General and distinguished himself at Cumberland Gap and in other campaigns.

The dilemma met by the Morgans at the outset of the Civil War was not atypical. Stephen H. Long and Charles Fuller of the Corps of Engineers were dredging the mouths of the Mississippi River in 1861. Colonel Long rescued federal funds from New Orleans banks and went north to become Chief of Topographical Engineers for the Union. Fuller resigned to become colonel of Confederate Army engineers.

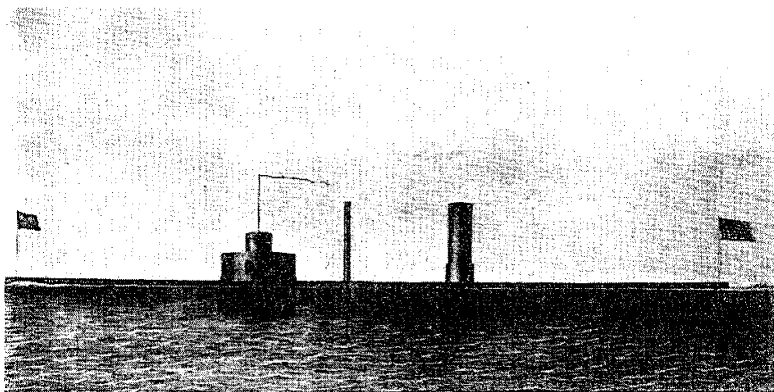
Colonel Long prepared plans for the Union inland river squadron for service during, he said, the "unhappy civil war with which our once peaceful country is now afflicted." He warned that Union gunboats should have the minimum draft because of government neglect of waterways during the prewar years. He was the last Chief of Topographical Engineers. They were merged with the Corps of Engineers in 1863, and General

Richard Delafield became the first Chief of Engineers.

Like the Morgan family, the Army Engineers were divided by the war. Of the 93 officers in the Corps in 1861, fifteen resigned to join the Confederacy. Confederate generals Robert E. Lee, Joseph E. Johnston, and P. G. T. Beauregard had been Army Engineers before the war, as had Union generals George Meade, George McClellan, William Rosecrans, John Pope, and James McPherson. Those who did not accept field commands built fortifications, roads, and bridges throughout the nation for either the Union or Confederate armies.

The first incident of the war in the headwaters district occurred at Pittsburgh in December 1860, when Secretary of War John Floyd, a Southerner, ordered a hundred cannon shipped from Allegheny Arsenal to New Orleans aboard the steamer *Silver Wave*. Pittsburgh newspapers opposed the move and a mob stopped the cannon rolling from the Arsenal to the Monongahela wharf. General James K. Moorhead spoke to the irate crowd at Allegheny Court House on December 27 and perhaps averted riot by urging that public peace be preserved until he heard from Attorney General Edwin Stanton. Stanton arranged cancellation of the cannon shipment, and perhaps wisely: the *Silver Wave* was seized by Confederate sympathizers on the Arkansas River and its cargo confiscated.

The people of western Virginia owned few slaves, were developing a mining and industrial economy, and were linked more closely by waterways to Ohio and Pennsylvania than to eastern Virginia, and both pro-union and pro-secession forces trained on the streets of several cities; at Clarksburg they used the city hall park on alternate nights. But Wheeling was strongly pro-union, perhaps as a result of the fact that it was a major industrial center sandwiched between two free states; and the people of Wheeling led the movement for formation of the separate state of West Virginia.



Monitor *Umpqua*

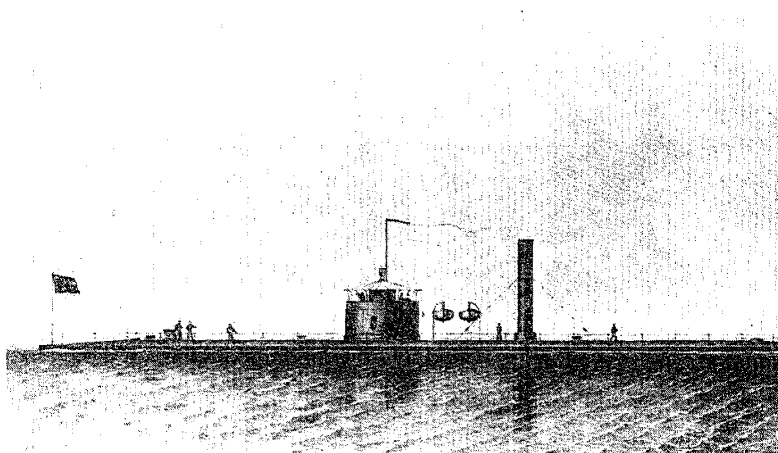
Western Pennsylvania Historical Society

As it had during the Revolution, War of 1812, and Mexican War, the headwaters district became again a major military depot and staging area for the army in 1861. Pittsburgh, Wheeling, and other industrial centers became arsenals for the Union army and navy, producing cannon, armor, small arms, and ammunition and sending them in a steady flow by river and rail to the combat theaters. Fort Pitt Foundry (Knapp, Rudd & Company) alone produced 15% of all ordnance supplied the Union armies, including the largest cannon in the world. The cannon were tested at a proving ground at Tarentum. Munitions plants in the headwaters district produced more than 10% of all shells used by the Union; and the region achieved similar records in production of uniforms, wagons, harnesses, gun carriages, and other war materiel.

After hostilities began in April 1861, Judge William Wilkins of Homewood, who had initiated the Ohio River project in 1819, became chairman of the Pittsburgh Defense Committee and arranged quartering and equipping of volunteers at fairgrounds, renamed Camp Wilkins, on Penn Avenue. Soldiers assembled there from throughout the headwaters district; Allegheny raftsmen, for example, met at Warren, built skiffs, and floated the river to Camp Wilkins for training. At Wheeling, General William Rosecrans established his headquarters in the McClure House and a prisoner of war camp on Wheeling Island.

Monitor *Manayunk*

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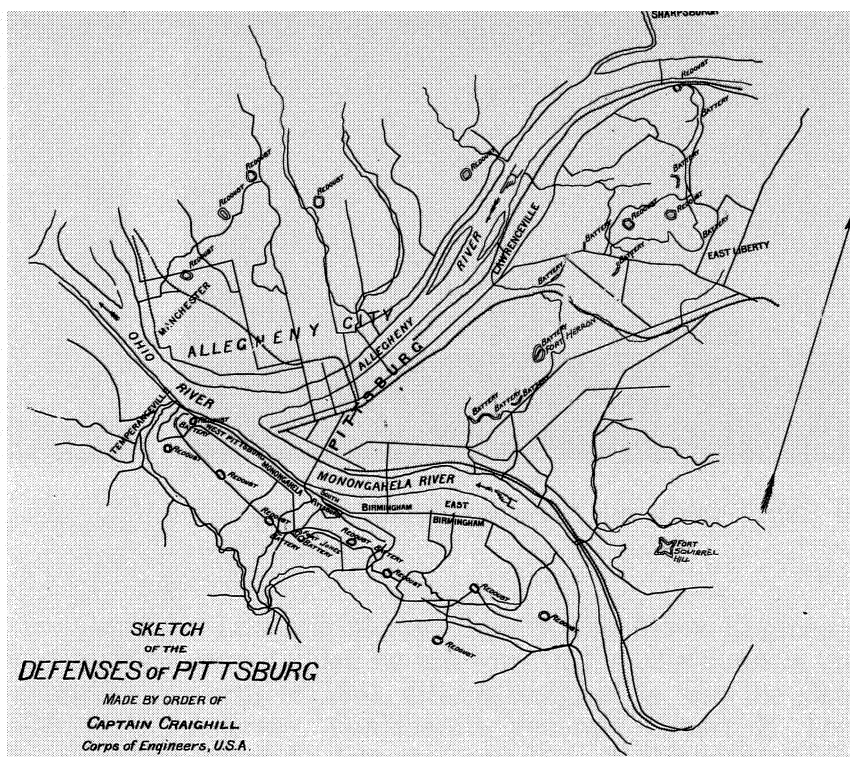


Shipping and shipyards of the headwaters were mobilized by William J. Kountz, superintendent of river transportation for General George McClellan, Captain John Rodgers of the Navy, and Colonel Charles Ellet. Kountz, a steamboat captain from Wellsville, purchased a steamboat fleet for service as Union transports and cooperated with Captain Rodgers in conversion of the steamers into "tinclad" gunboats. Ellet converted five Monongahela towboats into rams in 1862 for his assault on Memphis. The Navy also contracted with Mason and Snowden and Hartup and Tomlinson at Pittsburgh for construction of ironclads with revolving turrets of the monitor class. Towards the end of the war, Mason and Snowden launched the huge monitors *Manayunk* and *Umpqua* and Hartup and Tomlinson the smaller *Marietta* and *Sandusky*.

Former Engineer officers Robert E. Lee and George McClellan commanded the forces that fought the "first land battle" of the war on June 13, 1861, at Philippi on Tygart River. Lee sent Colonel George Porterfield into the upper Monongahela basin, and McClellan sent Colonel Benjamin F. Kelley and the First West Virginians from Wheeling to meet them. The sole Union casualty at the Philippi skirmish was Colonel Kelley. One of the wounded Confederates was James E. Hanger, who lost a leg. Hanger devised his own artificial leg and founded a factory for manufacture of artificial limbs that became the largest in the world.



General William P. Craighill



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With Engineer officers Orlando Poe, William E. Merrill, and H. W. Benham reconnoitering mountain passes, trails, and enemy camps in advance of the Union forces, Generals George McClellan and William Rosecrans dealt General Lee and the Confederates severe checks at Rich Mountain, Cheat Mountain, and Carricks Ford on Shavers Fork of Cheat, driving Confederates from the Monongahela basin and clearing the way for formation of the mountaineer state of West Virginia in 1863. But Confederate raiders penetrated into the region on many occasions throughout the war.

In April-May 1863, Generals John D. Imboden and William E. Jones rode across the Monongahela basin at the head of columns of thousands of grayclad troopers in a daring raid to break the Baltimore and Ohio Railroad, which was carrying munitions and supplies from the Ohio River basin to the Union Army of the Potomac. They crossed the

Monongahela basin at a trot, taking Rowlesburg, Morgantown, Fairmont, Grafton, Philippi, Buckhannon, and Weston, performing their mission, then leaving as fast as they had come, before Union forces could concentrate to meet them.

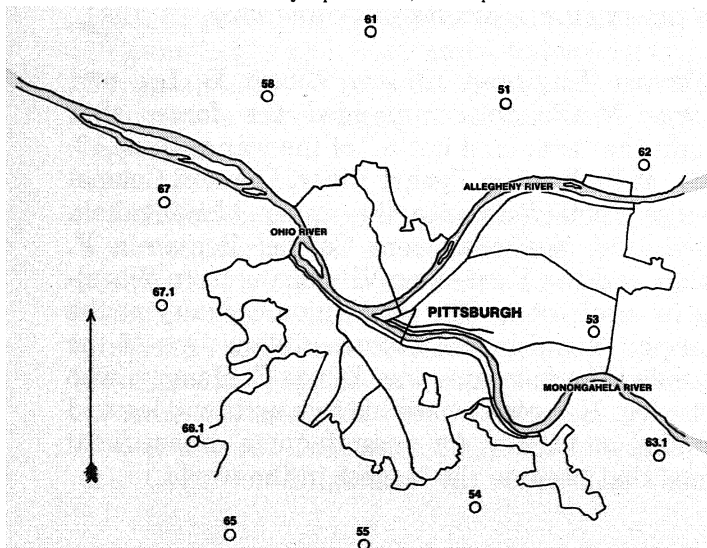
The Jones-Imboden raid at Morgantown, scarcely 75 miles from Pittsburgh, demonstrated that the headwaters district was not immune to attack, and the fright had not subsided before a new threat appeared. The Union Army of the Potomac lost contact with the Army of Northern Virginia and Confederate cavalry in Maryland, and the Confederates were marching north, perhaps even toward Pittsburgh.

Secretary of War Edwin Stanton approved mobilization of the Pittsburgh home guard in May 1863 and placed an artillery battery at its disposal. In early June, General James Moorhead, then candidate for governor, met with Stanton to urge more steps for protection of Pittsburgh from rebel raiders rumored moving toward the city; and on June 10 Stanton ordered General John G. Barnard, Colonel Cyrus B. Comstock, and Captain William P. Craighill to Pittsburgh to "assist the municipal authorities and the people in preparing for their own defense." "They are capable," the orders read, "and, it is presumed, ready to defend their town against any efforts the rebels may make to capture or destroy it. You will assist and animate them in the performance of this patriotic duty should the occasion arise."

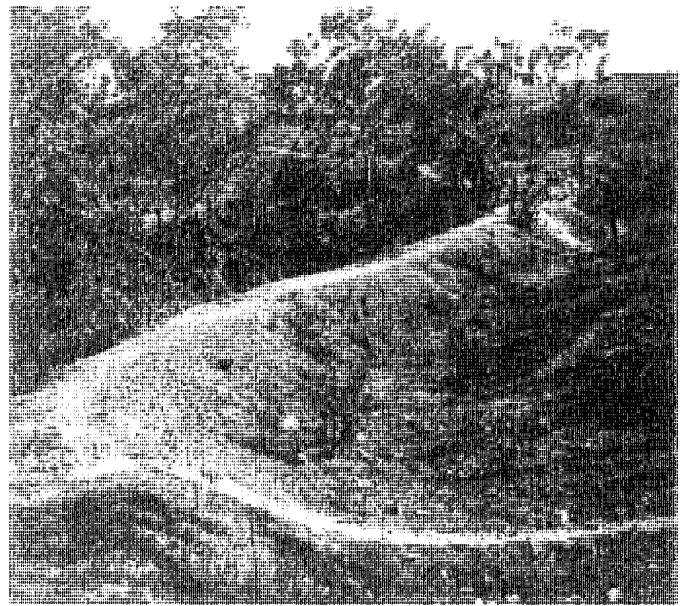
General Barnard and Colonel Comstock were engineers and aides to General U. S. Grant; Captain Craighill was a fortification expert. A Virginian,

90mm Antiaircraft sites 1952-53

History repeats itself; see Chapter 14



1863 Defense site - Fort Herron
(Photograph in 1890)
Carnegie Library of Pittsburgh



Craighill had refused commission in the Confederate army and also rejected Union field command where it might be necessary to fire on his friends. During the war he served as chief engineer to General George Morgan, fortified Cumberland Gap, Pittsburgh, and other points, and built blockhouses for defense of railroads.

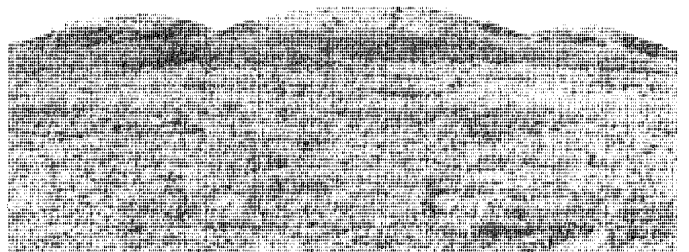
The Engineers planned Pittsburgh's defenses, laying out a line of trenches connecting 31 redoubts and artillery emplacements on a line atop Coal Hill from West End to Beck's Run, from Gazzam's Hill above Soho to the Allegheny opposite Sharpsburg, and, on the north side, from Uniondale Cemetery to Troy Hill. General W. T. H. Brooks, commanding the Department of the Monongahela, met with Pittsburgh civic leaders on June 14 and demanded they get on with the project, and on June 15 business ceased as 10,000 miners, mill and plant workers began digging trenches, rifle pits, and building redoubts and batteries. News that General Lee had entered Pennsylvania accelerated the shovels. Artillery from Allegheny Arsenal rolled into the forts, 5,000 militia marched into the trenches, and the city was ready to receive an enemy by July 4, when the Confederate army was turned back at Gettysburg.

Army Engineers designed and built fortifications not only at Pittsburgh, but also at Cincinnati, Louisville, Nashville, Paducah, and scores of other sites in the Ohio basin during the war, and most, like those at Pittsburgh, were never needed. Union authorities never knew, however, where intrepid Confederate units might strike, and even temporary capitulation of major cities and industrial centers to fast-moving Confederate cavalry would have been a terrific blow to public morale and a dangerous in-

terruption to war production. The threat was not illusion or panic. John Hunt Morgan and his Confederate cavalry proved that during their ride through Indiana and Ohio to East Liverpool in July 1863. In fact, the Union armies were at their best where engineering was paramount: the Union armies never quit a siege once begun, nor lost a major fortified city to Confederate siege.

River Work Resumes, 1865 Inland rivers were the backbone of Union supply service in the West during the Civil War. Union quartermasters chartered 640 steamboats for supply transport, of which 143, valued at near \$4 million, were sunk by obstructions or Confederate artillery. Lewis B. Parsons, chief of Union river transport, wrote an eloquent tribute at the close of the war to the western rivermen:

Much credit is also due to the boatmen of the west,...who have so often and patiently



1863 Defense site - Fort Jones
(At top of Castle Shannon Incline;
photograph in 1890)
Carnegie Library of Pittsburgh

submitted to the seizure of their transports and effectively assisted in securing the success of our armies during the last four years. It has often fallen to my lot to witness the cool bravery and acts of daring of this class of men in the passage of batteries or the sudden and unexpected attack of bands of guerrillas while navigating our western rivers; and Generals Grant and Sherman, with many others, will bear witness that none have shown greater firmness and resolution in danger or more reckless daring and disregard of personal safety...It was by the services of such men that the government was enabled so rapidly to concentrate re-enforcements at Donelson and Shiloh; that with seven days notice it was enabled to embark forty thousand men under Sherman in mid-winter for movement against Vicksburg, and subsequently precipitate the same force upon and capture the post of Arkansas. It was their courage that piloted our transports past the batteries of Island No. 10, Vicksburg, and numberless other places along our western waters; and all who have seen the unblanched cheek and steady arm by which the pilot at the wheel or the captain on the hurricane roof have discharged their duties in hours of danger cannot fail to acknowledge that they justly deserve a page in the history of the events of this war.

TIDIOUTE

Built at Tidioute, Pa. on the Allegheny River, 1865. 63.13 tons. Came out new at Pittsburgh Oct. 1865, Capt. Amos Dingley of Warren County, Pa. She had lake engines, brought from Erie, Pa. and ran on 8" of water. Sold to the U.S. after a period of use on the Allegheny. Her name was changed by the U.S. to *MAJOR SANDERS*, honoring Major John Sanders, U.S. Topographical Engineer in charge of the Ohio River 1837-1844.

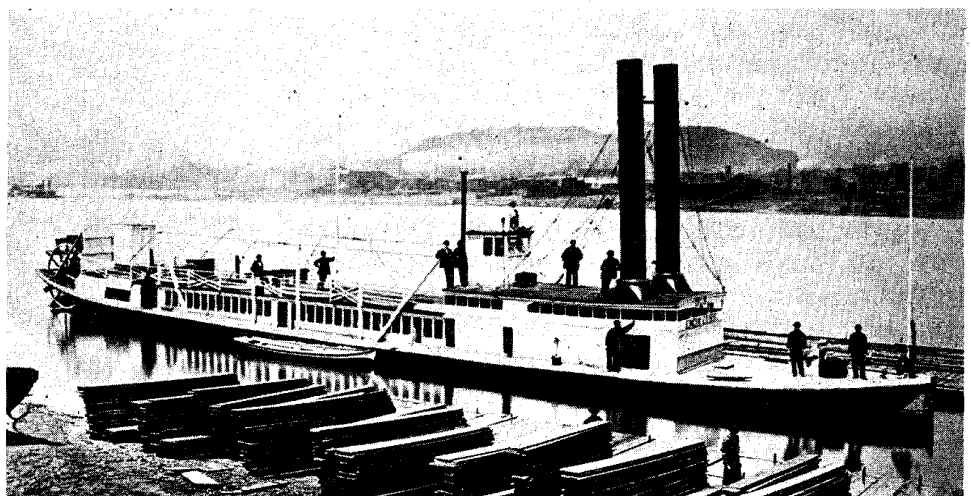
Running on the Allegheny in June 1866, to Oil City.

Enroute up the Ohio River with a party of U.S. Engineers on an inspection tour, July 1869. Captain Fred Way

One of the first acts of the new government of West Virginia in 1863 was to ask Congress for renewed work on the rivers, claiming the course of the war clearly demonstrated the national defense values of improved waterways. In the case of *Gilman vs. Philadelphia* in 1865, the Supreme Court ruled that the Constitution gave the federal government power to keep the rivers open and free from any obstructions, and to punish those who obstructed them. That favorable court decision, the eclipse of the states' rights element of the Democratic party, and the rise of the Republican party that was firmly committed to federal civil works projects produced a climate favorable to renewed work on the rivers.

Congress in 1865 directed Chief of Engineers Richard Delafield to review prewar projects and make report. The Chief found inland rivers, after a decade of neglect and war, had become filled with snags and wrecked boats. None of the snagboats and equipment used by Colonel Long and Captain Sanders survived, but data they gleaned from experiments and experience were available. General Delafield recommended immediate resumption of snagging and clearing projects, and Congress appropriated \$55,000 in 1866 to fund the work.

General Delafield ordered Colonel John N. Macomb to Cincinnati on August 22, 1866, to reopen the Office of Western River Improvements that Colonel Long had closed in 1856. Macomb had been



the first Army Engineer to build installations for an Army Air Corps; as chief engineer to General McClellan, he had directed construction of launching pads for the Balloon Corps of the Army of the Potomac. Macomb purchased the steamboat *Commodore* and converted it to the wrecking boat *J. G. Totten*, complete with submarine armor, diving bells, derricks, and explosive torpedoes, and sent it to blow wrecks of bosts sunk during the war from the channels. He hired E. M. Shield, builder of rams for Colonel Ellet in 1862, as chief of design for a new fleet of snagboats. In rapid order, the snagboats *S. H. Long*, *J. J. Abert*, *R. E. DeRussy*, *S. Thayer*, and the dredge *Octavia* were launched and sent to patrol the lower Ohio, Mississippi, Missouri, and Arkansas rivers.

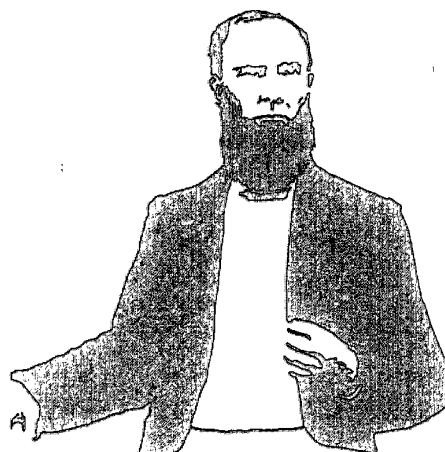
Major Henry Clay Long, son of Stephen Long, inspected the new doublehull snagboats and pronounced them superior to the "toothpullers" built by his father, John Sanders, Henry Shreve, and "Roaring Jack" Russell before the war. The old boats had a single pair of steam engines; the new boats had six pair and could raise snags and saw them without disconnecting the main engines from the paddlewheels. By 1870, Macomb's new snaggers had fairly cleared major inland streams of snags and wrecks accumulated from 1856 to 1866.

The Roberts Clear the Ohio "The mosquitoes nearly killed me last night, and at daylight the flies set to work to cut me off," complained Thomas P. Roberts. "It was a fearful night," he said, with ill humor. Nor was he pleased with the food aboard the *Major Sanders*, and breakfast had been especially bad. He had fired both cooks the previous week, one on account of the "length of her tongue" and the other because her morals were not "A No. 1." That had been a mistake, for one did not learn in engineering school how to scramble an egg. He was, nevertheless, well pleased with the little steamer *Tidioute*, the new survey boat he had renamed *Major Sanders* in honor of the former Pittsburgh District Engineer. It drew only fourteen inches of water and saved the government money, while disappointing the greedy teamsters who

waited with oxen and towlines at Ohio River shoals to pick up an easy ten bucks from stranded steamers. But he would have to move the pilothouse; it was located over the boiler and "sweat just rolled off a fellow."

Roberts anchored the *Major Sanders* at Logstown Bar on June 25, 1867, broke out survey chains and instruments, and put new recruits overboard to the top of Major Sanders' old riprap dam to take measurements. "Men for this riverwork ought to be over six feet tall and have strong toenails," Roberts thought, for they had to hang on in four feet of water atop the rock while the river thundered over the dam. He took secret pleasure in baptizing new recruits for the survey party on such dams. He picked them up in a skiff after they were swept downriver, and permanently employed those who returned to the dam after the experience.

Thomas had come to the Ohio with his father in 1866. The Corps of Engineers had been decimated by war, not enough officers were left for civil works, and Secretary of War Stanton and "Old Slackwater" Moorhead had selected William Milnor Roberts to renew the Ohio River project, finish the river survey begun in 1838 by John Sanders and plan the "radical" improvement of the river.



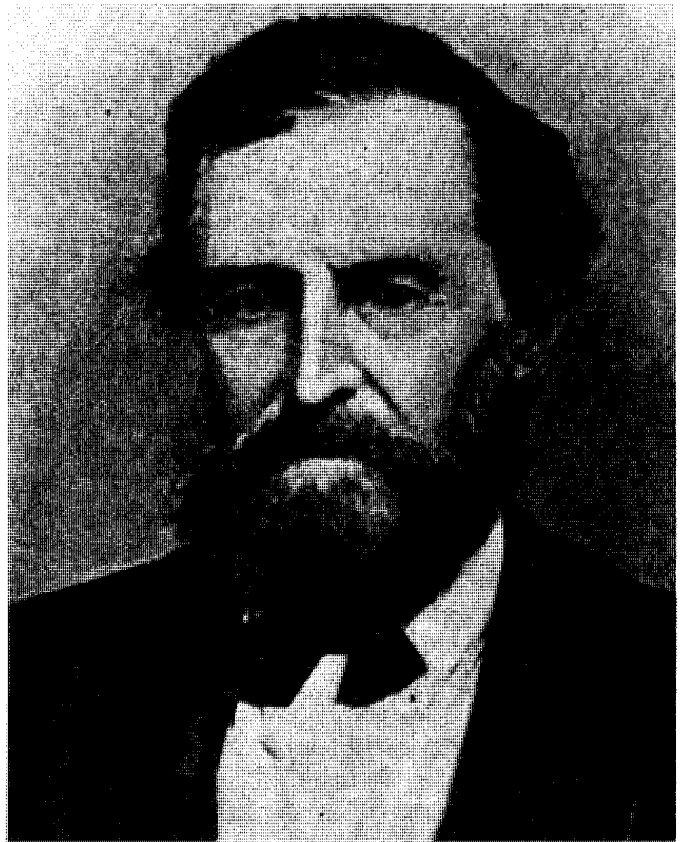
Captain George W. Rowley

Milnor Roberts received his appointment on August 3, 1866, opened a temporary office at Third and Market streets in Pittsburgh, then moved on October 1 to the U. S. Customs House at the corner of Smithfield and Fifth Street. He hired his son Thomas as assistant and George W. Rowley as chief pilot.

Captain George W. Rowley knew the Ohio better than any other man. He had emigrated to Kentucky in a flatboat as a child, had run flatboats and keelboats in the Pittsburgh to New Orleans trade, had piloted the steamers *Buckeye State*, *Crystal Palace*, *Thomas Swann*, *Alvin Adams*, and others, had captained river gunboats for the Union, and had become known as the "best packet pilot on the Ohio." His job was to get the engineers up and down river at low water, the best stage for surveying. "In seasons of real drought," he told Roberts, "there isn't much difference as to depths on the shoals. If you hear a pilot talking about such and such rapids having a foot or so better water than other neighboring rapids, put him down as a raftsmen. He knows nothing about genuine low water, when the Ohio drops like going down steps with risers the same, but with different treads."

Milnor Roberts chartered the *Greenback* from former Navy Captain John Rodgers in September 1866 and went down the Ohio with Rowley piloting, while Thomas Roberts updated the old Sanders maps, and he located obstructions needing immediate attention and collected commercial statistics. Roberts found the riprap dams built by his old friend Sanders had become so compacted that it took a crowbar to loosen them, but many needed repairs.

Roberts learned that 301 steamboats with 77,769 registered tonnage had been launched at Pittsburgh during the war. The city had 11 boatyards employing 500 men, 24 machine shops producing steamboat engines, 12 plants manufacturing steamboat boilers, and 10 forges making chains, anchors, and boat ironwork. When he learned the annual value of Pittsburgh manufactures was \$80 million, he com-



■ Milnor Roberts

Courtesy MG Milnor Roberts

mented there was no limit "to the future manufacturing and commercial greatness of this favored point. Nature had done all that any city could ask; enterprise has already effected very much, and future enterprise will effect much more."

He was impressed by the revolution that had occurred in the coal shipping business since he had designed the Monongahela slackwater project. When he planned the locks for the Monongahela in 1838, they had been large enough for the "French Creeks" that carried the coal to New Orleans. He learned that in 1866 about 7,000 men worked in the Monongahela mines, producing 2.5 million tons annually, of which two-thirds went downriver, mostly in the 1,500 barges pushed by 98 steam towboats. Barge tows were also transporting oil from the Allegheny and manufactured iron from Pittsburgh, Steubenville, and Wheeling. "It is reasonable to



Thomas P. Roberts

Courtesy MG Milnor Roberts

believe," Roberts predicted, "that after a while a large proportion of the steamers engaged in freighting will be towboats, running in connection with barges. Some single steamers will of course still be useful in carrying on the local passenger and freight business between the numerous commercial points along the river. . . . but the bulk of the freighting will probably be ultimately carried on by means of barges towed by steamers."

Roberts doubtless knew that Henry Shreve had towed keelboats with the *Enterprise* in 1814 and that other river captains had done the same, but early tows were actually towed, lashed alongside or aft of the steamers. In 1845, however, Daniel Bushnell had *pushed* three coalboats from Pittsburgh to Cincinnati with the little 28-ton *Walter Forward*. Bushnell put the *Black Diamond* into the towing business in 1851, and in the same year Captain

Hugh Smith began pushing coal tows with the *Lake Erie* from his Dilles Bottom mines near Moundsville. In 1854, Captain Charles H. Cockran steered the *Crescent City* pushing the first tow of 64,000 bushels of Monongahela coal to New Orleans, launching a trade to which there seemed to be no bottom. Except for an interruption in the early years of the Civil War, Louisiana sugar refineries and ocean steamers at New Orleans purchased all the Monongahela coal they could get.

It was an amazing sight when the markers showed the Ohio had risen to a seven-foot stage at Glasshouse Ripple next to Brunot Island. The coal tows, like huge floating islands, left Pittsburgh one behind the other. Through narrow channels, round sharp bends, between bridge piers, where a misturn of the wheel, a failure of judgment, a miscalculation meant wreck and disaster, the pilot guided the tow, now backing, now flanking, now pushing, now floating. Like the tail wagging the dog, the steamboats at the rear of massive coal islands turned them round bends, squeezed between piers, flanked past the points, and checked in narrow channels. Wrecks were frequent, disasters common, for the Ohio was full of obstructions. Milnor Roberts knew it was his job to do something to help those lonely pilots at the wheel of each tow.

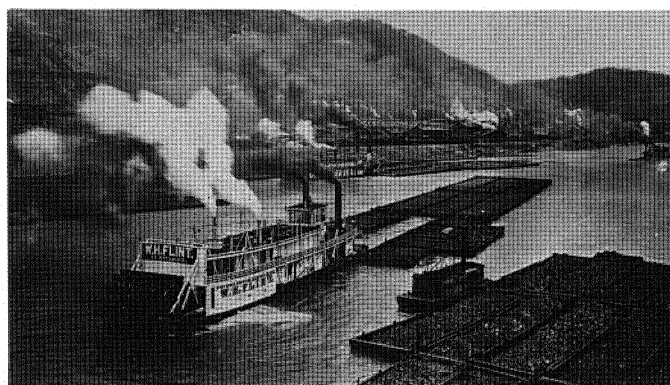
Milnor and Thomas Roberts, Captain Rowley, and Chief Clerk John Vandergrift (who indeed was the only clerk) moved into the Customs House at Pittsburgh in October to spend the winter planning resumption of the Sanders survey of the Ohio and their snag-fishing and rock-hunting work. A great deal of their time, however, was consumed by accounting and paperwork. They shipped their vouchers to Washington, which returned them for correction and, after the corrections had been made, issued new directives requiring preparation of new vouchers. "We are drowning in red tape," Thomas Roberts complained. "Uncle Sam has sent no funds as yet so we whistle our credit. It has been rather a losing business so far. The devil himself can't tell how much will be refunded."



Milnor Roberts employed engineers Alonzo Livermore, the Pennsylvania canal engineer who also canalized the Green River in Kentucky, and Sigismund Low, the railroad construction engineer who founded the Pittsburgh *Volksblatt* newspaper, to continue the Ohio River survey. Thomas Roberts purchased flatboats, equipped them, and employed surveymen; he and Captain Rowley aboard the *Major Sanders* towed the survey parties in flatboats from Pittsburgh in June 1867, and delivered them to the point where Captain Sanders had ended the survey in 1844. Though delayed by floods and by fevers that sometimes incapacitated the entire force, Low and Livermore finished the survey to the mouth of the river by November 7, 1868, and produced 118 maps on a scale of 1.3 inches to the mile, which were so accurate that they served the Corps until 1898.

The Ohio was obstructed by snags at 90 places, by drift piles at 66 places, and by 46 wrecked steamboats and 83 sunken barges in 1866. Milnor Roberts contracted with Captain John Rodgers and his steamboat *Greenback* for \$88.50 a day to restore a clear channel on the upper Ohio; with Captain T. W. Spencer and the *Zebra* to clear the stream between Cincinnati and Evansville; and with Captain James Routh and the *Petrolia* for work below Evansville. The contractors and their small steamers had trouble pulling snags that were up to 120 feet long and 5 feet through the butt. Captain Routh and the *Petrolia* once broke chains, wore out saws, and consumed four days removing a single monster pecan. By 1869, Roberts had concluded the Ohio River snagging project needed a Shreve "toothpuller."

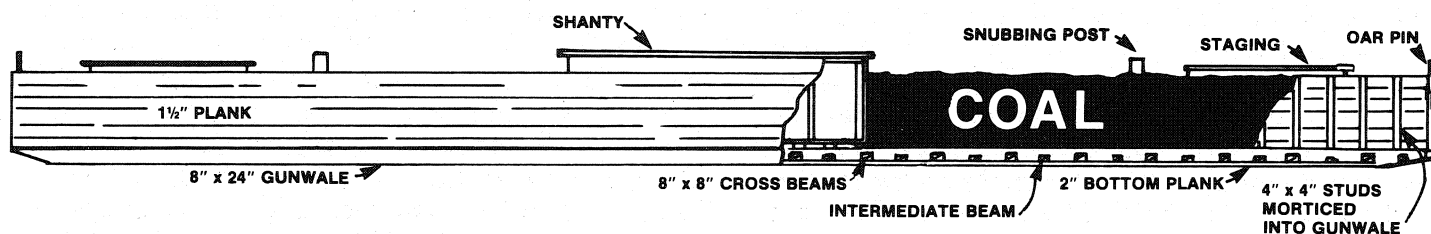
In the days before the towboat, coalboats proceeded downriver in fleets during the spring high water.



Coal tows

Because funding was meager, Roberts concentrated on rebuilding the Sanders dams and adding a few new wing dams on the upper river, where coal tows had the greatest difficulty. An increase of six inches channel depth allowed each boat and barge to carry 70 tons more freight, and Roberts explained: "An improvement of one foot in depth along the Ohio navigation is a matter of very great importance, involving material benefit to the commerce of the country, far beyond the sums expended in accomplishing it." He contracted with Swan & Fenton, Routh & Lane, C. M. Cole, J. J. Power and Charles Cable for repair of the Sanders dams at White's Ripple, Logstown Bar, Twin Islands, Captina Island, Fish Creek Island, and Petticoat Bar, and he planned construction of more low riprap dams at Wheeling Island, and other points. He did not employ project inspectors at each worksite; instead, Captain Rowley and Thomas Roberts traveled from site to site continuously in the *Major Sanders* to assure proper stone placement and to measure the amount of rock quarried by the contractors and dropped into place.

As had John Sanders at Browns Island in 1837, Milnor Roberts encountered opposition to several dams. He planned at Wheeling Island, as example, a dam to close the Ohio (right) chute, diverting low-water flow down the West Virginia chute. When he let the construction contract on October 10, 1868, the people of Bridgeport, located on the Ohio bank opposite Wheeling, protested that while a covered bridge from their town to the island closed steamboat navigation through the Ohio chute, a coal tippie



and keg factory located above the bridge shipped their products by river. They asked that the West Virginia chute be dredged and construction of the dam across the Ohio chute be stopped.

Roberts described the incident as a conflict between public and private interest and said it was a "delicate task to decide to what extent either or both should be compromised." A dam at the head of the Ohio chute was preferable from an engineering standpoint, but Roberts compromised by building the dam below the covered bridge, placing a wing dam at the head of Wheeling Island, and dredging the West Virginia chute to a limited extent.

Roberts' efforts greatly improved the upper river channel in three working seasons. The Pennsylvania General Assembly, in an 1870 petition to Congress asking further funding for the work begun by Roberts, declared: "The small expenditure made on this river during the past three years has resulted in great benefit to the navigation. A few inches added to the depth of water on the shoaliest bars extended the number of days that a trade amounting to \$2,000,000 per day can be conducted, while the removal of snags and wrecks has saved many losses to the community at large, as well as to those engaged in the river trade, and to insurance companies."

Merrill Revises the Open-Channel Project "There certainly is an urgent need of larger appropriations than those of the last two years—\$50,000 each year," urged Colonel William E. Merrill in 1871. "For a river one thousand miles long, with a commerce estimated at over \$500,000,000, the sums lately appropriated are insignificant." Merrill explained that, while Roberts had done much good with limited funds, necessary administrative and office overhead took too large a percentage of each small appropriation.

The outspoken Colonel who succeeded Roberts at Pittsburgh in 1870 seemed to relish lecturing Congress on the shortcomings of its waterways policies; he did so throughout the two decades he served as District Engineer. Tops in the Class of 1859 at West

Point, William Merrill, because of his strict personal standards, almost brutal honesty, and fondness for foreign languages, was known to his friends as "Padre." He once resigned as Louisville (Ky.) District Engineer because a politician controlled appointments and interfered with project performance. During the Civil War, while performing frontline reconnaissance for the Union Army, he was wounded and captured by Confederates. After his exchange, he built fortifications throughout the South and demonstrated remarkable engineering talent through development of improved ponton bridges, better railroad defense systems, and faster map-production facilities. He began his study of international waterways engineering in the postwar years and was assigned to Pittsburgh on June 17, 1870.

Milnor Roberts left the Corps of Engineers in 1870 to help build the Eads Bridge over the Mississippi at St. Louis; he and Thomas rode muleback across the Rockies in 1872 to locate the route of the



Colonel William Merrill



Snagboat *E. A. Woodruff*

Captain Fred Way

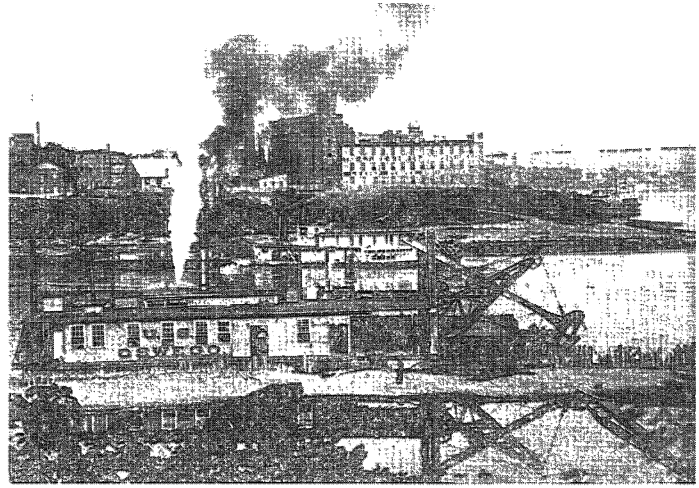
Northern Pacific Railroad. Milnor became president of the American Society of Civil Engineers in 1878, then returned to Brazil as chief of public works. Thomas returned to Pittsburgh to work for Colonel Merrill on the Allegheny River and later for General Moorhead as chief engineer of the Monongahela Navigation Company.

"Padre" Merrill began reorganization of the Ohio River project in 1871. Because he was responsible for improvement of the entire Ohio River and for all its tributaries except Cumberland, Tennessee, and Wabash rivers, he relocated the District office from Pittsburgh to Cincinnati on June 1, 1871, to reduce travel costs. (Colonel John Macomb in 1870 moved the Office of Western River Improvements from Cincinnati to St. Louis.) He also launched campaigns to secure sufficient allotment from river and harbor appropriations to permit construction of improved dam structures and an Engineer snagging and dredging fleet for the Ohio River project and to obtain federal funding for marking river channels.

With support from the interstate Ohio River Commission, chaired by General Moorhead, Merrill won

increased funding for the Ohio River and began construction of an Engineer floating plant. The snagboat *E. A. Woodruff*, completed in 1876, was single hull with Shreve snag-beam between double bows. Equipped with steam saws, derricks, grapples, and blasting appliances, with Captain George Rowley and later William H. Christian at the wheel, the *Woodruff* patrolled the Ohio from end to end each year, often tailing the Monongahela coal fleet downstream to remove wrecks as fast as they occurred. Merrill had designed the *Woodruff* with an iron hull because he thought its higher construction costs would be amortized by long service and also as a test project for the edification of marine design engineers. The iron hull paid off. the *Woodruff* served the Corps and Ohio River navigation until 1926, and its hull was used as a wharfboat until 1940.

Milnor Roberts and "Padre" Merrill had contracted with Benjamin L. Woods and others of Pittsburgh for dredging, but prices ranged up to a dollar per cubic yard of excavation. They learned that emergency contracts for dredging troublesome shoals could not always be arranged and that



U.S. dredge *Oswego*
Captain Fred Way

private dredges often had insufficient power for the work. In one instance, a dredging contractor, who could not lift boulders out of the river with his machinery, simply dredged out holes and rolled the boulders into them.

Merrill built the dipper dredges *Ohio* and *Oswego* in 1872 and 1874 and placed E. J. Carpenter in command of the two. Ready for action at a moment's notice, the two dredges worked for less than 25¢ per cubic yard in 1874, slashing dredging costs 75%, and reimbursed their construction costs within two years. Merrill put them on iron hulls in 1882, and the *Oswego*, renamed the *Northern No. 2*, was still dredging for a private firm as late as 1970.

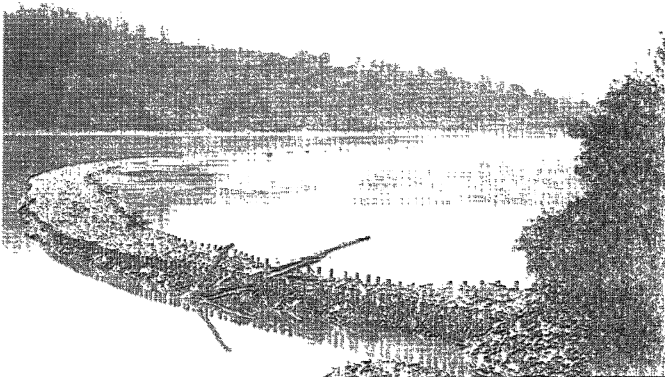
Because of meager funding, Roberts had confined dam construction to the upper Ohio; Colonel Merrill extended construction to the lower Ohio and devised an improved dam structure. Shreve, Sanders, and Roberts had built dams of rubble stone piled on the riverbottom, with the largest stones atop the structures and a few wooden piles to provide stability. In 1876, Merrill commenced a cribwork dike atop the old stone dam at White's Ripple, eleven miles below Pittsburgh. The new cribwork dam was five feet higher than the old dam and consisted of two parallel timber walls spaced twelve feet apart, rigidly drift bolted, bound together with timber

crossties, and filled and paved with stone. The 3,000-foot experimental cribwork dam at White's Ripple functioned for more than a half century, and nearly all stone dikes built on the Ohio and Allegheny rivers after 1877 followed the design of the Merrill cribwork dam.

"Besides appropriating money to improve the river channel," Merrill said in his 1870 report to Congress, "I think that Congress ought to provide for lighting and buoying it." Congress had provided for lighthouses and buoys along the seacoasts since 1789, but river traffic had been forced to rely on pilot recognition of bluffs, lone trees, farmhouses, and topographic features to locate channels; night time navigation was exceedingly hazardous. Colonel Merrill recommended establishment of lighthouse districts for the Ohio and other inland streams with authority to install white marker towers with lanterns on the banks and to place channel buoys.

Rivermen lent their support to Merrill's proposals, and in 1874 Congress established inland river lighthouse districts, which placed 150 marker lights and buoys on the Ohio in 1875. Corps officers commonly served as directors of lighthouse districts; those at Pittsburgh served in the 14th Lighthouse District, which by 1920 had 503 signal lights and daymarks on the Ohio and 173 on its tributaries. The Coast Guard took charge of the channel marking system at the outset of the Second World War.

Benefits of the channel markers, channel clearance by the Engineer floating plant, and the cribwork dams were substantial. Yet, as soon as the Engineers cleared an adequate channel at one point, the rivermen found other locations to complain about to their congressmen. Funding was never sufficient to improve all shoals simultaneously, nor would open-channel methods have ever created sufficient channel depths for year-round navigation. "Padre" Merrill agreed with Milnor Roberts: nothing save the permanent and "radical" improvement of the Ohio River would suffice.



Merrill cribwork dam on the Ohio